

PSYCHOLOGY TEACHERS UPDATE

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EVOLUTIONARY PSYCHOLOGY

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PSYCHOLOGY TEACHERS UPDATE

Psychology Teachers Update is designed to give a brief overview of the main developments in the different areas of psychology. There is a proliferation of journals and research, and it is very difficult to keep abreast of the latest trends, particularly in the many and varied areas of psychology.

Each issue of Psychology Teachers Update will cover a particular topic, and summarise the main research directions and findings in the last ten to fifteen years approximately. The aim is to give teachers the feel of what is happening in that area of psychology.

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Introduction

Archer (2001) enthusiastically begins his article on evolutionary psychology (EP):

Over a relatively short period of time evolutionary psychology has become a prominent way of understanding the human mind and behaviour (p414).

The application of evolutionary ideas (or the adaptationist approach as Alcock (1993) calls it) is not just a recent phenomenon. Wilson's (1975) book on sociobiological explanations for human behaviour began the "modern" debate.

Barash (1982) believed sociobiology to be a new paradigm, while Hinde (1982) felt that it was a new term for what behavioural ecology had also covered.

Cartwright (2000) thinks that sociobiology has more of an interest in human behaviour than behavioural ecology, and prefers the term: "human behavioural ecology" (a combination of behavioural ecology, population biology, and social ethology). Table 1 compares sociobiology, and behavioural ecology as applied to human behaviour with EP on different criteria.

	SOCIOBIOLOGY	BEHAVIOURAL ECOLOGY	EP
Level of explanation	behaviour	behaviour	psycho-logical mechanisms
Hypothesis-generation from	"gene's eye view"	optimality models (*)	inference
	reasoning	- fitness maximisation	evolution theory/history
Main methods	ethnography	quantitative; ethnography	questionnaires; lab experiment
Comparison of humans with:	Pleistocene human behaviour; hominids (human ancestors); primates; animal studies; optimality models	optimality models	Pleistocene human behaviour;
Is behaviour adaptive?	yes	yes	not always, because of time lags

(* see Winterhalder and Smith 2000)
(After Laland and Brown 2002)

Table 1 - Comparison of three evolutionary explanations.

Sociobiology produced a strong reaction which still underlies the application of evolutionary ideas to human behaviour (discussed in Laland and Brown 2002).

Alcock (1993) summarises the main criticisms of the time for Wilson and sociobiology, and then defends them (table 2).

CRITICISMS OF SOCIOBIOLOGY (from Daly and Wilson 1987)	ALCOCK'S (1993) DEFENCE
1. "Sociobiology is E.O. Wilson's own theory of human behaviour"	Sociobiology is a synthesis of ideas from evolutionary biology about the social behaviour of all animals, and specifically applied to human social behaviour
2. "No one has ever identified the genes responsible for any human behaviour"	The aim of sociobiology is not to specify individual genes, but to highlight the evolutionary bases of behaviour
3. "But humans don't do things just because they want to raise their inclusive fitness"	"No animal...or human, needs to be aware of the ultimate reasons for its activities in order to behave adaptively" (p544)
4. "But not all human behaviour is biologically adaptive"	Some behaviours (eg: celibacy in priesthood) could be a "maladaptive by-product" of other adaptive behaviour
5. "Sociobiology provides aid and comfort for those who would maintain social injustice and inequality"	It is important to distinguish the evolutionary explanation for a behaviour, and the assumption that the behaviour is morally right (1): "..sociobiology is a discipline that attempts to explain why social behaviour exists, not to justify the behaviour" (p546)

Table 2 - Common criticisms of sociobiology and their defence by Alcock (1993).

WHAT IS EVOLUTIONARY PSYCHOLOGY?

Evolutionary psychology (EP) ⁽²⁾ differs to sociobiology in its focus on "the adaptive mental mechanisms possessed by humans that were laid down in the distant past - the so-called environment of evolutionary adaptation (EEA)" ⁽³⁾ (Cartwright 2000 p28).

For, Cosmides and Tooby (1987) "natural selection cannot select for behaviour...it can only select for

mechanisms that produce behaviour" (p281). While Wilson (1998) calls EP, "human sociobiology".

Whatever the term used to describe "Darwinists", they assert that:

the existence of human universals upon which the essential unity of mankind is predicated. Some cultures may amplify some of these universals and suppress others, and culture itself may in some as yet unclear way reflect the universals lurking in the human gene pool, but the crucial point is that these universals represent phylogenetic adaptations: they have adaptive significance (Cartwright 2000 p29).

Tooby and Cosmides (1992) emphasise that EP is psychology based on the principle that the human mind is the product of evolution. Trying to understand such evolution will enhance the understanding of contemporary behaviour. In fact, it is like "reverse engineering" (Tooby and Cosmides 1992): to infer the function of a behaviour in the evolutionary past from its current existence.

It is important to note that from an evolutionary point of view, certain behaviours may fall into different categories (Alcock 1993):

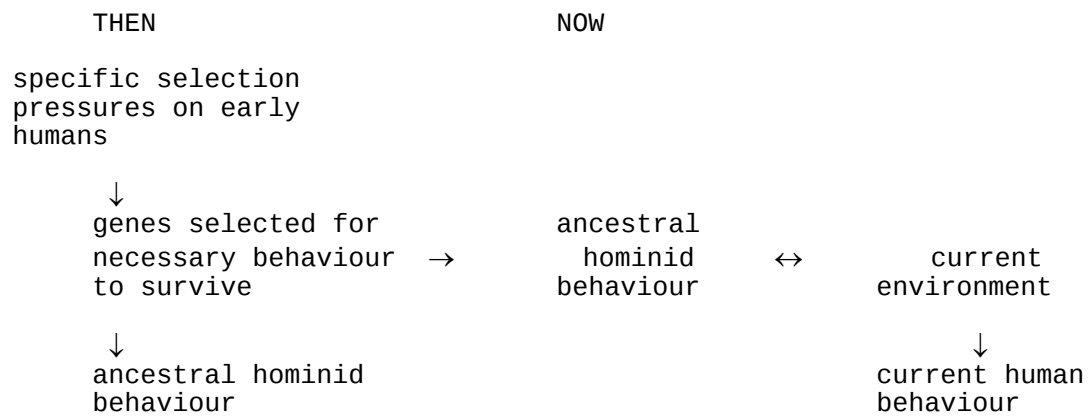
- i) the behaviour has direct or indirect benefits for evolutionary fitness;
- ii) the behaviour no longer raises evolutionary fitness, but did in different environmental conditions ie first appearance of humans (maladaptive to modern society);
- iii) the behaviour is not adaptive and is a by-product of an underlying adaptive mechanism.

Wilson (1975) notes that humanity has experienced "ecological release" in the last few thousand years. This is a lack of inter-species competition, which allows certain behaviours to persist that are not the most evolutionary fit.

What EP has emphasised more than sociobiology, behavioural ecology, ethology or Darwinism, is that current human behaviours are a "product of contemporary environmental influences acting upon ancestrally designed mental hardware" and thus, "we should expect to find mind mechanisms that were shaped by the selective pressures acting on our distant ancestors" (Cartwright 2000 p46).

The period of focus is the Pleistocene age (1.7

million years ago (MYA) to 100 000 approximately) (Laland and Brown 2002) ⁽⁴⁾. Figure 1 shows how this emphasis works in understanding current human behaviour.



(After Crawford 1993)

Figure 1 - How current human behaviour is a product of the ancestral environment.

EP attempts to pose questions and explain behaviour at a number of levels (Cartwright 2000):

- i) teleologically - basic level of explanation;
- ii) proximate causal mechanism - usually seen as the underlying physiology (similar to Tinbergen's (1963) causal questions ⁽⁵⁾);
- iii) ultimate causal mechanism - ie advantages conferred from this behaviour (similar to the functional question of Tinbergen's four question).

Figure 2 shows an example of the levels of explanation.

EXAMPLE: Why do males have many sexual partners?

- teleological level: to increase opportunities for more offspring
- proximate level: physiological mechanisms of ease of sexual arousal
- ultimate level: advantages conferred by this behaviour

Figure 2 - Example of levels of explanations in EP.

While Buss (1990) suggests a hierarchy of levels of analysis in EP:

- top level: principle of natural selection;
- second level down: principles of evolution governing social behaviour (eg: kin selection; reciprocal altruism);
- third level: hypotheses about what to expect generally;
- fourth level: testable hypotheses about specific circumstances.

Three principles are key to the understanding of EP (Stevens and Price 1996):

i) Universality of behaviours in all cultures.

However it is feasible that there will be different behaviours in different cultures:

Suppose, for the sake of argument, that an operational adaptation for adjusting one's personal level of aggression to the current level of aggression observed in the environment occurred in both ancestral and current children. If the distribution of aggression seen on TV by children differs from the level of aggression that ancestral children would have seen, then the identical operational adaptations may produce quite different levels of aggressive behaviour (Crawford 1998a p23).

ii) Phylogenetic continuity - in the process of evolution there is no break between humans and non-humans.

iii) Evolutionary stability - "patterns that are evolutionary stable are sustained through the selective penalization and ultimate elimination of individuals who fail to manifest them" (Stevens and Price 1996 p33).

But "current behaviour need not contribute to current fitness" (Crawford 1998a). There are also "problematic behaviours" (Crawford 1998b) (figure 3):

a) "true pathology" - behaviour that is detrimental in both ancestral and current environments: eg Huntington's chorea, phenylketonuria;

b) "pseudopathology" - behaviour that contributed to ancestral fitness, but is "maladaptive, unethical, or otherwise harmful" today; eg: obesity, prostitution, wife abuse, excessive male jealousy;

c) "quasinormal behaviour" - detrimental to ancestral

fitness, but contributes to wellbeing today; eg: adoption of genetically unrelated children, recreational sex, "true altruism".

PAST - ADAPTIVE		
CURRENT - ADAPTIVE	YES	NO
	YES continuing adaptive behaviour	"quasinormal behaviour" (or "exaptation"*)
	NO "pseudopathology"	"true pathology" (or "dysfunctional by-product")

(* not built by natural selection for current role: Laland and Brown 2002).

Figure 3 - Different types of behaviour.

However, Dawkins (1995) reduces all behaviour to gene perpetuation:

..so long as DNA is passed on, it does not matter who or what gets hurt in the process. Genes don't care about suffering because they don't care about anything...(p67).

The methodology used in EP follows a number of steps (Tooby and Cosmides 1989):

Step 1 - use evolutionary theory to develop models of adaptive problems that early humans had to solve.

Step 2 - establish how adaptive problems manifest in Pleistocene era, and thus what were selective pressures.

Step 3 - Catalogue specific information processing problems that need to be solved for adaptation (and develop computational model).

Step 4 - Use computational theory to design features needed to adapt.

Step 5 - Eliminate alternatives with field research.

Step 6 - Compare conclusions in step 4 with modern behaviour patterns.

If all the steps are followed, then EP is

"scientific", and not "just-so-stories" (which is a common criticism) (Tooby and Cosmides 1989).

EP is growing in popularity in terms of books and articles. A good technical introduction in Crawford (1998a) and review appears in Caporael and Brewer (1991); The best recent books are Cartwright (2000), and Laland and Brown (2002).

The "Psychologist" August 2001 has a debate about the principles: Archer, and Buss versus Campbell, Segal, and Rose and Rose. The most detailed recent critique is Rose and Rose (2000).

The debate between Richard Dawkins and Stephen Jay Gould over the last twenty years is explored in Sterelny (2001), but it is quite biological. Ruse (2001) explores the history of evolutionary ideas. While Radcliffe Richards (2000) explores the philosophical issues about human nature.

Human Sexual Behaviour

The basic principle of sexual selection as applied to the male and the female of a species are assumed for humans. Thus there are different strategies for men and women:

- male reproductive success in terms of multiple mates, which produces male competition;
- female reproductive success in terms of choosiness about the "best genes" and the male who will support the upbringing of the offspring.

Buss and Schmidt (1993) highlight the specific concerns thus for males and females in short-term and long-term relationships (table 3).

CONCERNS	RESULTING BEHAVIOUR
MALES	
SHORT-TERM RELATIONSHIPS	
1. gaining access to multiple partners	- evolution of sexual preference for variety
2. identifying which females are sexually accessible	- low standards for choice of partners
3. minimise costs	- spend little time with before mating
4. identify which females are sexually receptive	- not waste time on those not receptive ie older females; look for signals of youth
LONG-TERM RELATIONSHIPS	
1. confidence in paternity	- mate guarding strategies
2. how to assess reproductive value	- physical attractiveness as signals of youth and health
3. how to assess quality of genes	- as above
4. identify females who will commit, and be good parent	- look for signs (not clear what are signs)

CONCERNS	RESULTING BEHAVIOUR
FEMALES	
SHORT-TERM RELATIONSHIPS	
1. immediate resources	- look for males who signal this: eg paying for date
2. evaluate if possible long-term partner	- coyness; resist sex too in date
3. how to assess gene quality	- look for male characteristics that signal good genes
4. mate switching or mate back-up	- better genes or security if usual mate deserts or dies
LONG-TERM RELATIONSHIPS	
1. identifying males who invest resources in offspring ie willing and/or able	- look for signs of resources or potential resources
2. identifying males who will commit, be good parents, and protect	- coyness to allow assessment of male characteristics
3. assessing gene quality	- look for signs: eg tall

(After Buss 1998)

Table 3 - Different concerns for males and females in short-term and long-term relationships.

AVOIDING INCEST

Mating is paramount, yet, at the same time, it is important not to mate with those who are too genetically related because of the higher risk of recessive traits appearing.

Dispersion of the offspring at puberty is one mechanism that animals can use to avoid incest. The "Westermarck hypothesis" (Westermarck 1891) originally suggested that biology turns off sexual arousal to close genetic relatives.

Recent research by Wedekind et al (1995) has highlighted another mechanism: females prefer the smell of males who are different in terms of the immune system, or specifically the major histocompatibility complex (MHC) region of the genome, as measured by antigens in body fluids. Such combination of different immune systems help the offspring to fight parasites.

In their experiments in Switzerland, the researchers asked women to smell the sweat on clothes of men genetically related and unrelated to them. The women

preferred the smell of those unrelated, except when taking oral contraceptives, where the opposite was true.

The taboo against incest can also be seen in social norms; eg: unrelated children raised together on Israeli kibbutzim rarely marry ⁽⁶⁾. Thereby reducing the risk of marrying a relative (Parker 1976). Other situations where children are brought up together and then marry produce fewer offspring than the average (eg: minor marriages in China or parallel-cousin marriage in Lebanon) (Boyd and Silk 2000).

Bateson (1986) suggests a two-stage process of common evolution trends first, and secondly the development of taboos as language and cultural rules appeared. But there are exceptions; eg: ancient Egyptian royalty and brother-sister marriage (Ruse 1989).

MALE COMPETITION FOR FEMALES

Male competition for females may be violent or more often not, but will underpin most aspects of behaviour. Daly and Wilson (1988), for example, analysed homicide data to support the former. Males are far more likely to die from homicide than females at all ages.

The most obvious manifestation of male reproductive success is multiple partners; ie: affairs outside marriage or long term relationship (Symons 1979). Any children fathered from the affairs, while the man remains married, increases the reproductive success by 50% of his genes with no parental investment.

Symons (1979) predicts that the male brain has thus evolved with psychological drives and desires related to multiple partner copulation, and sexual variety (as shown, for example, in the interest in pornography and visiting prostitutes). These two behaviours are maladaptive in modern society because prostitutes use contraception, and pornography does not increase reproductive success, but their underlying mechanism is adaptive.

Short (1994) has argued from male physiology that there is a tendency towards multiple partners. Male chimpanzees have multiple partners, and they possess large testicles relative to their body size (60g with 50kg average male body weight; ie: 0.3% of body weight). Human males have smaller testicles relative to body size (20g to 70kg; up to 0.08% of body weight), but not as small as gorillas (10g to 250kg; 0.02% of body weight), who live in harems. The "testicular effect" in humans is

closer to chimps, and suggests that "we are not inherently monogamous" (Short 1994). This manifests itself today in the best program of "serial monogamy" (Cartwright 1986).

COERCIVE SEX

Alcock (1993) argues that the male drive for multiple partners can be seen in coercive sex (including rape). Thornhill and Thornhill (1983) have argued that rape is a conditional sexual strategy: ie a behaviour that may be an evolutionary advantage in certain environmental conditions. In other words, where there is a shortage of females, this behaviour may be advantageous to some males (eg: subordinate).

Thornhill (1981) draws most of his ideas from work with *Panorpa* scorpionflies, where small males who could not provide a "nuptial gift" (like dead insects for the female to feed upon during or after copulation) resorted to forced copulation. Rape is a "reproductive option of last resort".

An alternative evolutionary explanation is that coercive sex is a maladapted by-product of the male sexual drive, which has ease of sexual arousal, desire for variety, and a readiness to engage in impersonal sex (Alcock 1993). Other animal species will engage in clearly non-reproductive success; eg: male elephant seals mount weaned pups (Rose et al 1991).

Not surprisingly, these ideas have produced anger and concern from many, including feminist writers (7) like Susan Brownmiller (1975). She argues that rape is about controlling and intimidating women: "nothing more or less than a conscious process of intimidation by which all men keep all women in a state of fear". Furthermore, evolutionary arguments for rape serve to justify and excuse the behaviour, argues Fausto-Sterling (1985).

To add insult to injury, Thornhill and Thornhill (1983) argue that rape may be motivated to control women, but there is still an underlying evolutionary basis - some raped women do become pregnant. Rape is an act of sex, not violence, argues Palmer and Thornhill (2000) (8). Table 4 outlines the main predictions about rape from EP, and the feminist replies.

PREDICTIONS FROM EVOLUTIONARY
EXPLANATIONS OF RAPE (Alcock 1993)

FEMINIST REPLIES

- | | |
|---|---|
| 1. victims = women of peak reproductive years | 1. victims from all age groups, including children and older women clearly not able to reproduce (Ochert 2000); also male rape of males (9) |
| 2. victims sometimes become pregnant | 2. much rape does not involve ejaculation inside the women (Brownmiller 1975) |
| 3. rapists = unmarried, poor men; ie: lacking resources | 3. rapists from all strata of society |
| 4. rapists = individuals with unusually high sex drives | 4. rapists are products of the construction of masculinity and patriarchy (10) |

Table 4 - Predictions from EP about rape and feminist replies.

SPERM COMPETITION AND MATE GUARDING

Though males may desire multiple partners, it is difficult for them to know if the offspring in the family are theirs. It is possible for the female to have multiple partners, leading to sperm competition (Parker 1970), and the "best sperm" fertilising the eggs. Thus males have evolved strategies to guarantee paternity of the offspring that they are caring for in the family.

Smith (1984) has studied the evolution of male anatomy, in particular the weight of human testes and the number of sperm contained in an ejaculation. In practice, the quantity of sperm will thus vary depending upon the risk of the presence of rival sperm.

Baker and Bellis (1989) studied this amongst student couples by measuring sperm quantity captured in a condom (average amount was 389×10^6 sperm per ejaculation). Where the couple had not been separated and copulated regularly, the quantity of sperm was low; ie: no need for large amounts because little opportunity for rival sperm to be present. But the longer the couple separated, the larger the quantity of sperm per ejaculation; ie: an attempt to swamp the rival sperm (eg 712×10^6 sperm per ejaculation on average).

Within the larger quantity of sperm are those whose task is to block or destroy rival sperm, not fertilise the egg. This is the "kamikaze sperm hypothesis" (Baker and Bellis 1995). The ideas of sperm competition are developed in Baker (1996).

Another strategy to guarantee paternity is mate guarding, which is seen culturally as marriage. Thus the male accepts the cost of loss of partners (as in polygyny) for the assurance that the offspring in the families are his.

Daly, Wilson and Weghorst (1982) note the violent response of husbands to affairs by their wives (24% of spousal homicides by men were motivated by jealousy compared to 7.7% for women in Canada 1974-83; Daly and Wilson 1988), and the legal defence of adultery when the male murders his unfaithful wife. Men are more concerned about unfaithfulness in applying for divorce as found in Canada, and England and Wales (Buckle et al 1996).

As part of mate guarding, sexual jealousy in males has evolved. This would make males more attentive and vigilant of their females. Buss et al (1992) developed a simple experiment to show the difference in types of sexual jealousy shown by males and females.

Students were asked which would distress them most: (a) imagining their mate having sex with another person, or (b) imagining their mate having a deep emotional attachment with another person. Of the women asked, 85% were more distressed by (b), which fits with predictions of sexual selection - loss of male support is most damaging to women. While 60% of men found (a) more distressing, and this is because they cannot guarantee the paternity of their offspring. As always, this experiment is not without criticisms.

Males will use a variety of tactics to retain their mates (table 5).

TACTIC	EXAMPLE
- vigilance	- call mate unexpectedly
- concealment of mate	- not introduce to male friends
- monopolise mate's time	- spent all time with her
- emotional manipulation	- say "die without her"
- derogation of competition	- criticise her male friends

(After Buss 1992)

Table 5 - Mate tactics for retaining mate.

Wilson and Daly (1992) list cross-cultural practices that reflect the male concern of paternity:

- veils/purdah/incarceration (ie: hiding women)

- chaperones
- foot-binding (to limit movement)
- genital mutilation of women; eg: clitoridectomy
- status in law of women as men's property
- menstrual taboos; eg: the Dogon (Mali) send women to the "menstrual hut", thereby forcing them to signal their position in the fertility cycle (Strassman 1996).

CONCEALED OVULATION

Marriage as mate-guarding also exists because of the difficulty of determining when females are fertile. In some species, there are obvious signs of female ovulation, but in humans this is hidden and so males must guard their females for longer.

Concealed ovulation can be seen as an example of "life-history theory" (a subset of natural selection theory) (Low 1998). "Life-history theory" argues that:

...characteristics we see represent trade-offs in allocating effort between survival and current reproductive; between current vs future reproduction; and, within current reproduction, among offspring of different sex, size and number...what an organism spends in one endeavour cannot be spent in another (Low 1998 p131).

Other examples include size of baby at birth and development post-natal, and parental investment.

Alexander and Noonan (1979) see concealed ovulation leading to the "daddy at home hypothesis": the male stays at home and pays attention to the female to assure his paternity. The conflict between the sexes as part of co-evolution: males want to spread their genes but females evolve strategies against this and for their benefit.

Also concealed ovulation could prevent infanticide by males, and is an example of a "dishonest signal" given by females of their reproductive status (Hrdy 1979). This is sometimes called the "nice daddy theory".

On the other hand, Christenfeld and Hill (1995) argue that paternal genes express facial features in the infant that make them recognizable to the father as their own offspring.

Participants asked to match photographs of children of different ages with their genetic parents, were only successful for one year olds, not older children.

Furthermore, concealed ovulation allows the female

to seek out "clandestine copulations" - the "cuckoldry hypothesis" (Schroder 1993). All of this gives the "battle of the sexes" a very different slant.

FEMALE MATE CHOICE

As in most species, females choose the males with the best qualities to aid in the survival of offspring, and the "best genes" for that offspring. Thus females look for those males with resources; ie: wealth, or potential wealth in earning power or particular skills (Buss 1987).

Buss (1989) has found these characteristics to be important across 37 different cultures (table 6). It should be noted that this research is questionnaire-based.

FEMALE PREFERENCES PREDICTED BY EVOLUTIONARY THEORY	CULTURES SUPPORTING PREDICTION (out of 37 studied)
- males with earning potential are attractive	36
- males with ambition are attractive	29

Table 6 - Summary of results from Buss (1989) for female mate choice.

In a non-Western setting, Kaplan and Hill (1985) studied the Ache people (Paraguay) where hunting ability is key. Children of "good hunters" survived more often to adulthood than those of "poor hunters". Furthermore, "good hunters" were more likely to have extramarital affairs confirming the desirability of such characteristics.

For the Kipsigis people (Kenya), the amount of land owned by the husband is key (Borgerhoff Mulder 1987), while number of cattle owned is important for Yomut (Iran) (Irons 1979). In both cases, wealth is linked to survival of offspring.

Historically, Boone (1986) found that women in 15th and 16th century Portugal married to nobility had more children than those married to untitled husbands. Two key observations come from male wealth: more surviving offspring in the marriage, and more surviving illegitimate offspring (table 7).

RANK OF HUSBAND	MEAN NUMBER OF ALL OFFSPRING	MEAN NUMBER OF ILLEGITIMATE OFFSPRING
royalty	4.75	0.52
landed aristocracy	4.54	0.37
untitled/military	2.33	0.23

(After Boone 1986)

Table 7 - Summary of findings from study of rank and number of offspring in 15th and 16th century Portugal.

But in modern society, there is little difference between the number of children in poor and rich families. In fact, in some cases, richer families have less children.

Perusse (quoted in Alcock 1993) argues that the principles of EP still hold. Using "number of potential conceptions" (NPC); ie: number of matings in one year, from questionnaire research with French-Canadian men, Perusse found that success in multiple matings linked to wealth and status.

While Pawlowski et al (2000) highlight the importance of height in males. Using the records of over 4000 healthy Polish males (aged 25-60 years), they found that, holding all variables constant, childless males were significantly shorter in each age group, and bachelors significantly shorter than married men.

The preference of females has been found to change over the menstrual cycle. Penton-Voak et al (1999) showed that Japanese female students preferred less feminine male faces in the high-conception-risk phase of their cycles. But, in the same research, British female students had different preferences depending upon whether the scenario was for a short or long term relationship.

For the latter situation, the preference was constant throughout the fertility cycle: more feminine than for short-term relationships. The researchers explain the results:

A female might choose a primary partner whose low masculine appearance suggests co-operation in parental care...but occasionally copulate with a male with a more masculine appearance (indicating good immunocompetence) when conception is most likely. Sexual behaviour arising from cyclic preferences might allow individuals to accrue benefits from polyandry while maintaining the

advantage of ostensive monandry (pp741-2).

Generally, females are looking for the "best males", and Miller (1998) has argued that the human brain evolved as a product of this process: ie females choosing males who were inventive and creative. The female brain evolved in parallel to be able to decode and appreciate these inventive male displays.

Miller (1998) is not afraid to speculate: men produce more art, music and literature than women; mostly in young adulthood; and as a "courtship display". Furthermore, humour, acting, metaphor, sports, games, ritual, myth, ideology, religion, politics, and science also "fall under the rubric of courtship behaviour" (Miller 1998).

Alternatively the "big brains" may have evolved to allow males to outwit each other in gaining females (and females to do the same for males). I emphasise the word "speculate" here for all these ideas.

For males, it is always about advertising their "good genes". One suggestion is that men use alcohol, tobacco and drugs as a means to show how tough they are, and that they can cope with such mistreatment (quoted in Clamp and Russell 1998).

MALE MATE CHOICE

Male mate choice will be based on different criteria compared to female choosiness. Kenrick et al (1990) asked college students their minimum acceptable level of intelligence in a partner for casual sex or for marriage. Both sexes set high standards for a long term partner, but males reduced the figure by over half for casual sex. Females did not change their minimum standard for such situations. For males, availability of opportunity matters more than the quality of casual sex partners.

Likewise, males are more likely to reply "certainly would" or "probably would" to the scenario of a no strings/no consequences extra-marital affair (50% vs 25% females), while the majority of females replied "certainly not" (70% vs 20% of males) (Symons and Ellis 1989).

However, males should prefer fertile women: ie those at the age of peak fertility (23-28 years old). This can be seen most obviously in the emphasis on female physical appearance and attractiveness (Buss 1989). Table 8 summarises the cross-cultural findings of Buss (1989).

MALE PREFERENCES PREDICTED BY EVOLUTIONARY THEORY	CULTURES SUPPORTING PREDICTIONS (out of 37 studied)
- physical appearance of females important	34
- younger females attractive to all age groups of men	37

Table 8 - Summary of results from Buss (1989) for male mate choice.

The prediction that men want women with high fertility potential (ie: many years of fertility ahead as well) has been tested through the use of dating ads.

For example, in the USA, Kenrick and Keefe (1992) ⁽¹¹⁾ analysed the ads in the "Arizona Solo" newspaper, and the "Times" of India. Concerning age, males always asked for younger women irrelevant of their age, while females tended to seek partners of a similar age to themselves (if not slightly older).

Other such studies in the UK include 1600 advertisements from "Private Eye" magazine (Greenless and McGrew 1994), and Dunbar (1995). Grammer (1992) found similar results in computer dating in Germany. Table 9 summarises the main findings from dating ad studies.

MALES WANT

physical appearance young age	evidence of fertility
----------------------------------	--------------------------

FEMALES WANT

finance/status or potential eg: ambition	evidence of resources
---	--------------------------

Table 9 - Summary of predictions and findings from studies of dating advertisements.

However, research by Jagger (1998) challenges these universal features in dating advertisements. In her survey of such advertisements in the "Herald", "Scotsman", "Guardian", and "Independent", she found some differences in what is offered and required by each sex.

Lifestyle choices (eg: sport) are now more important than resources in men, and women "market" their "masculine" attributes (eg: ambition), while selecting "feminine" men (eg: nurturing). The body is important to both sexes. Table 10 gives details of the main characteristics found as important.

TOP THREE CHARACTERISTICS
OFFERED (% adverts)

MEN

- | | |
|----------------|----|
| 1. Body | 56 |
| 2. Personality | 52 |
| 3. Resources | 35 |

WOMEN

- | | |
|----------------|----|
| 1. Body | 58 |
| 2. Personality | 58 |
| 3. Lifestyle | 42 |

TOP THREE CHARACTERISTICS
WANTED (% adverts)

MEN

- | | |
|----------------------------|----|
| 1. Personality | 39 |
| 2. Body | 29 |
| 3. Physical attractiveness | 17 |

WOMEN

- | | |
|----------------|----|
| 1. Personality | 55 |
| 2. Body | 25 |
| 3. Resources | 16 |

(After Jagger 1998)

Table 10 - Top three characteristics offered and asked for in dating advertisements in Jagger (1998).

One well used technique is to present males with photographs of females and to choose those preferred. Singh (1993) introduced the idea of the waist-to-hip ratio (WHR) of 0.7 being the most desirable as seen in "Playboy" centrefolds and "Miss America" winners. It is not the actual weight, but the distribution of the weight that is key.

A WHR of 0.7 is associated with health and fertility. This preference was shown over sixty years even when the actual weight of models varied. Though this study was in the USA with white males, Singh (1995) found similar results with Chinese-Indonesian men arriving in the USA.

But Yu and Shepard (1998) challenged the universality of these findings with a study of the Matsigenka people of Peru. They have not been exposed to the Western media, and live in a hunter-gatherer type environment with food scarcity. The men here preferred women with a WHR of 0.9 (overweight from Western studies).

Low et al (1987) counter by suggesting that fat distribution in females is a "dishonest signal" to males of child-bearing potential; ie: pretending to have wide hips. Males have evolved the ability to distinguish "real" hips from "fat deposited" hips, and thus females respond by depositing fat on the hips and not on the waist; and so on. The evidence for this co-evolution is limited.

Because of these problems, males have evolved other "honest" ways of telling if females are healthy and fertile (these are true for both sexes):

a) symmetry of both sides of the body (Manning et al 1996) - a sign of lack of parasite infection as well as a sign of gene quality;

b) average facial appearance (Langlois and Roggman 1990) - a composite of 32 faces is more attractive than of two, for example. Again signs of parasite-resistant genes (Thornhill and Gangestad 1993). Both these signals cannot be faked;

c) general features of face preferred by men that signal youth: lack of facial hair (hair appears latter in life), and pale skin (skin darkens with age) (Cartwright 2000).

The existence of bridewealth payments to the husband and his family can be seen as evidence of male competition for "good females". Dowries to the wife and her family are much rarer.

Furthermore, in polygynous societies, rich men can "purchase" many wives to increase their offspring. The younger the woman, the greater the price: eg the Kipsigis pay more bridewealth for those who reach puberty sooner (Borgerhoff Mulder 1987). For example, for those women circumcised at 12 years old (seen as sign of puberty), the average bridewealth was nine units compared to seven for those circumcised at 18 years old.

Two other evolutionary benefits derive from these observations: (a) rich men are attractive to females and can guarantee resources for the offspring's survival, and (b) parents can increase their "inclusive fitness" by leaving their wealth to sons (and not daughters).

A son will be able to "buy" more wives, and thus increase the number of grandchildren. This will be pronounced in polygynous societies (Hartung 1982). In an analysis of 1000 Canadian wills, the richer the inheritance, the more likely it was to be left to sons (Smith et al 1987).

From the same analysis in British Columbia, it is clear that:

a) inheritances are left to kin (92.3% of total) compared to non-kin;

b) the closer the kin the more inheritance (eg 19.2% of inheritances to sons compared to 3.2% to grandchildren);

c) more left to own offspring than siblings (19.4% to daughters and 4.8% to sisters). These observations fit the kin selection theory (Hamilton 1964).

But in monogamous societies, it makes sense for

parents to give to their daughters to "buy" the right husband. She will be guaranteed the husband's wealth compared to a polygynous situation. Thus, in this situation, women are competing for husbands.

Gaulin and Boster (1990) found that dowries are much more common in monogamous societies: 29 of 173 societies compared to 6 of 893 polygynous societies studied.

The sex of the offspring (ie: sex ratio) is also influenced by the costs of producing males and females. Females are more likely to leave home to marry, and males thus inherit the family wealth. It is predicted then that high-status males will father more sons ⁽¹²⁾ (Cartwright 2000). Mueller (1993) calculated the ratio of sons to daughters for the most powerful men in the USA, Germany and Britain. The average ratio was approximately 115 boys born to 100 girls among their offspring, which is significantly different to the general population (105 boys:100 girls) ⁽¹³⁾.

Caring for Offspring

The investment for the care of offspring is obvious for women because they know the child to be theirs, but because the paternity is unclear, males will only care for offspring that they are sure are genetically theirs.

A number of sources of evidence are quoted to support this argument:

- i) The divorcing of rape victims by their husbands.
- ii) In societies where female sexual behaviour is more permissive, men tend to care for other genetic relatives than their own offspring: eg among Ifaluk (Pacific islanders), uncles care for their nephews and nieces on his sister's side because they are genetically closer than his own offspring when the paternity is unclear (Alexander 1979).
- iii) The negative attitudes of stepfather to stepchildren. Flinn (1988) noted twice as much conflict between stepfathers and stepchildren than among fathers and children in the same Trinidadian rural families. The stepchildren were also more likely to move out and live with their own genetic relatives, like grandparents.

Daly and Wilson (1985) have taken the argument further, and suggest that child abuse is a maladaptive side effect of the evolutionary tendency to care for genetic offspring. The process of selection on the human brain has promoted certain kinds of behaviour which generally increase fitness, but in some individual cases produce maladaptive behaviour. For the researchers, a step-parent is the "most powerful epidemiological risk factor for severe child maltreatment" (Daly and Wilson 1988).

Daly and Wilson found that, in the Canadian city of Hamilton, step-parents were forty times more likely to abuse young stepchildren than children with both genetic parents. The risk of child murder is much higher in families with step-parent(s).

Recent research by Enquist et al in Sweden have challenged the work of Daly and Wilson. The Swedish researchers looked at 139 child murders between 1975-95 in their country. They found that the key risk factor was one parent (even biological) against two parents, and that non-biological parents only accounted for 7% of the child murders (quoted in Motluk 2000).

But, if there is a evolutionary tendency against stepchildren, why do humans adopt non-genetic children? Sahlins (1976) sees adoption as a form of "true

altruism", and in certain Pacific island cultures is encouraged, such that about one-third of children could be adoptees. Silk (1990) counters by a re-analysis of these cultures, and found that many of the adoptees were distant genetic relatives.

Alcock (1993) lists the possible evolutionary benefits to adopting complete strangers:

- i) gaining helpers to the family unit that improve survival of everybody in a rural society;
- ii) a maladaptive by-product of the human motivation to have children, particularly evident among those families who have lost children. There is evidence of this behaviour among white whales, for example (Bremmer 1986).

PARENT-OFFSPRING CONFLICT

One area of evolutionary theory that has been applied to human behaviour is parent-offspring conflict (Trivers 1974): parent(s) want to invest a certain amount in each offspring, while each individual offspring wants all the investment to themselves.

The upshot is that there will be a certain age when the child demands more investment than the parent(s) are willing to give. For example, Badcock (1994) suggests that when young children retain urine and faeces, it is a strategy to suggest to the parents that there has been insufficient feeding.

Haig (1993) has applied this idea to pregnancy in humans: the maternal-foetal conflict. This conflict is evident:

- a) in the decision to miscarry in the first few weeks;
- b) glucose levels (leading to diabetes in late pregnancy);
- c) blood supply (seen in blood pressure changes in mother).

After birth, the presence of sedatives found in breast milk will reduce the demands of the infant.

There is also a conflict between the paternal genes, which want that child to grow as much as possible, and maternal genes, which prefer the mother to survive for future pregnancies. In the genetic abnormality of Angelman syndrome, the child has no maternal copies of certain genes on chromosome 15. These children are excessively demanding. Interest has focused upon insulin-like growth factor 2 (IGF-2) (Pagel 1998).

Evolution of the Human Mind

The complexity of the human mind compared to other species is not seen as due to single differences, but a product of a number of evolutionary pressures. The two main pressures discussed here are "social intelligence" and the problems faced by living on the savannah.

SOCIAL INTELLIGENCE

Whiten and Byrne (1997) proposed that human intelligence developed initially because of the social behaviour of early humans. The need for co-operation, or deceit and social manipulation. This is known as the "Machiavellian hypothesis".

Thus intelligence evolves as a means of solving problems in each species, and in humans, the main problems were linked to social interactions.

The key is the complex social order that early humans formed compared to other species. There are advantages to such groups in terms of sharing skills and resources, but there is also an individual advantage to exploiting other individuals within the group: competition and co-operation together. Such demands, and knowing when to use which one, requires a higher-level intelligence. Humphreys (1976) calls it a "creative intelligence".

Smith and Stevens (2002) summarise the state of early human societies:

..negotiating what is of best advantage to you at least cost, while the individual you are interacting with is making exactly the same calculations. Thus, co-operation becomes not a naive 'trusting' of others, but rather a calculated option. As an individual, the ability to cheat others would clearly increase one's chances of maximum individual benefit...the individual you are attempting to cheat will maximise his or her benefit by being able to predict when you are cheating. So begins a series of elaborate and complex calculations (p125).

The ability to survive in such a world will be enhanced by a "theory of mind": the ability to understand the intentions of another individual.

Whiten (1996) sees four forms of ability here:

i) implicit mind-reading - to understand another's experiences from their actions; eg: laying down to sleep

means experiencing tiredness;

ii) counter-deception - to distinguish between the action and another intention; eg: laying down to make you think they are tired, and thus avoid talking to you;

iii) recognition of intervening variables - knowing that events cause the person to behave in a particular way: eg a loud noise will cause the person to run away;

iv) experience projection - own experiences allow prediction of how person would behave in same situation.

To what degree, chimps have these abilities is open to discussion, but the evolutionary basis is there.

"MODULAR MIND"

Social intelligence is one of the pressures upon the development of the human mind. Another pressure which could go hand in hand is related to the development of cognitive processes. For example, the ability to use social intelligence is further enhanced by a good memory and the ability to learn socially relevant information (Byrne 1999).

These developments can be seen in the technical skills of tool-use and imitation. Again there is some evidence of these abilities among chimps, but the key in humans is the level of these skills.

Whiten (1999) argues that the move from the forests to open savannah was crucial for early human evolution. Catching prey required very different cognitive abilities, which relied upon memory and learning, compared to ancestors in the forest.

But tool-use by itself would not be enough to lead to the evolution of the "big brain": especially the sudden increase in size about two million years ago. Tool use by Neanderthals and homo erectus is little different to chimps today (Byrne 1995).

Evidence to support the importance of the move to the savannah comes from observations of hunter-gatherers in the modern world (14; eg: !Kung San of Kalahari desert. They shoot the prey with poisoned arrows; the prey runs off; and later the hunters track the animal to find the dead corpse (Lee 1979).

This is very different to how other species catch prey by always maintaining visual contact with it. The !Kung San method of hunting uses many cognitive skills: planning, representation of objects not physically present, reasoning, and the ability to make "technology"

(ie arrows and bows) (Whiten 1999).

These skills develop in a social context. Furthermore, the evolution of language improves both social interaction and the planning and proceed of hunting.

The cognitive skills of sophisticated hunting and social intelligence would be examples of "functionally differentiated modules" or "domain-specific mental modules" (Tooby and Cosmides 1992b) in the brain - each module having a specific function. The existence of these modules allows problem-solving, and, in particular, in new situations. The specifics change, but the general principles of the modules remain. For example, the module related to exchange allowed for barter in the past and detailed monetary transactions today (Gigerenzer 1997).

This module may involve certain abilities: including the recall of past exchanges with specific individuals, who cheats, and the knowledge of costs and benefits. The module may include cognitive, emotional, behavioural, and motivational processes (Gigerenzer 1997).

Cosmides and Tooby (1992) see the ability to detect cheaters as crucial. If "cheater-detection" is so important, then this ability will be evident in remembering information. Mealey et al (1996) have found this to be the case. Students were shown male facial photographs for a short period of time along with information about the person (in particular, whether they were trustworthy or not). One week later, recall was better for the faces described as untrustworthy.

Another key module is relational and abstract thinking (Tooby and Cosmides 1987). The modules that exist today in the brain are those that gave evolutionary advantages to early humans. The idea of modules tends to be a theoretical framework rather than clear physiological regions of the brain.

Geary (1998) lists some of the potential modules: language; facial processing; detection of cheating; theory of mind; kin recognition; in-group recognition; out-group recognition; social ideologies; representation of objects.

There are criticisms of these ideas. Cartwright (2000) notes the main areas of debate:

- a) the nature of the environment of evolutionary adaptation (EEA) where the "big brain" evolved;
- b) domain specificity of modules and the generalisation of abilities;

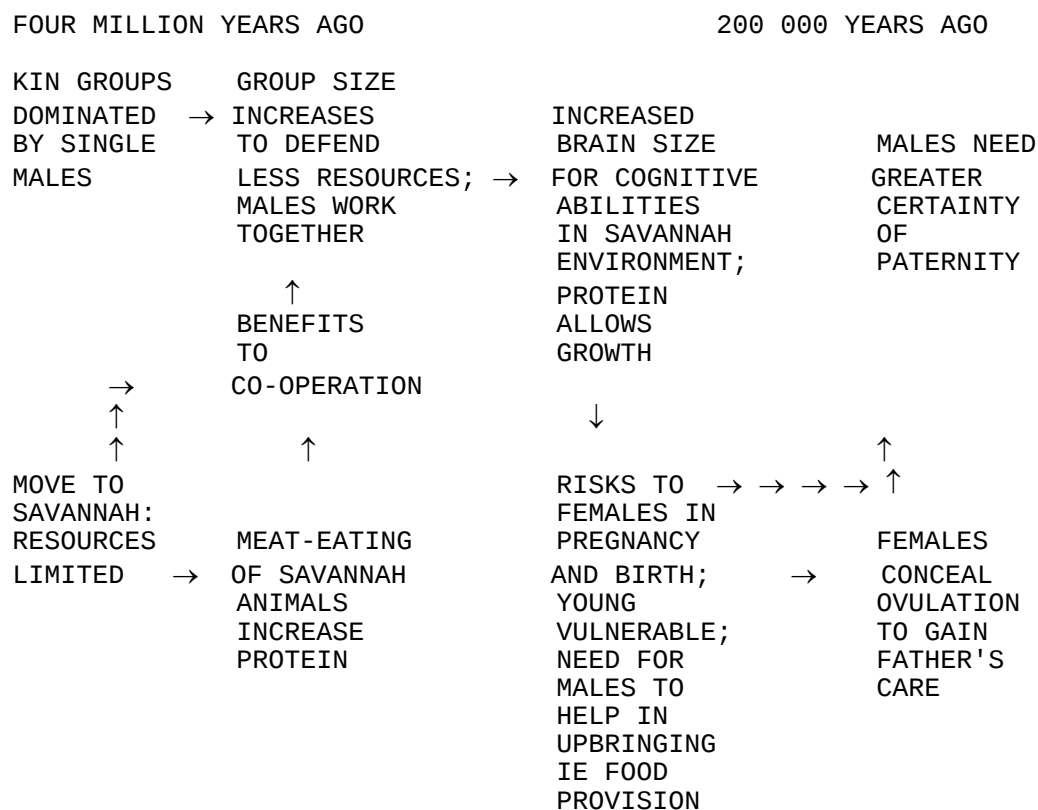
c) correspondence between modules and neurophysiological structures;

d) little genetic difference between humans and chimpanzees, yet large difference in abilities.

Gerald Edelman takes the arguments a step further with a selectionist view on the brain's evolution. Neurons and connections exist in the brain, and only those with strengthened connections remain, and they remain because of the demands of the environment. Thus neurons in the brain are working under the principles of natural selection (Dowling 1994).

In the same vein, it can be argued that consciousness evolved to enhance flexibility and control of behaviour, particularly in environments which are demanding, like the savannah (eg: Dawkins 1993). The need for the ability to spot discrepancies in the state of the environment, and then to respond to that (Toates 1996).

Along with Miller's (1996) idea that the brain evolved to allow males to create courtship displays for females, the various forces of evolution can be combined together (figure 4).



(After Cartwright 2000)

Figure 4 - Diagram of selection pressures on the evolution of the "big brain".

From a different point of view, Calvin (2002) argues that the increase in brain size was a product of surviving the cycle of climate changes that occurred in the past: one of the many "flip-flops every few thousand years" in the earth's climate. In fact, hundreds of such episodes led to the survivors - humans with "big brains".

Evolution of Social Behaviour

This section looks at the evolutionary explanations for a selection of social behaviours.

MORALITY

Wilson and Ruse (1985) are fairly definite in their views: "Ethics as we understand it is an illusion fobbed off on us by our genes to get us to co-operate" (p52).

Most of the analysis of pro-social behaviour is based around "inclusive fitness" for kin (Dawkins 1989), and reciprocal altruism (Trivers 1971), or "game theory" (Maynard Smith 1974) for non-kin. Axelrod (1984) explores "game theory" and the evolution of co-operation.

Badcock (1991) speculates in a different direction. The best outcome for an individual is if they are the cheater while everybody else does not. Morality could have evolved to "fool" the individual into believing that they are not motivated to be the cheater while encouraging everybody else to be altruistic.

Ruse (1989) speculates about the evolution of morality in terms of how morality may develop within an extra-terrestrial life-form on Andromeda.

Krebs (1998) divides the concept of morality into concern for others, respect for rules of justice, and respect for authority in trying to give an evolutionary explanation.

i) Concern of others - reciprocal altruism is usually the reason put forward for showing concern for non-kin. Symons (1979) argues that infant mortality could be as high as 65% in early human society, so any help would reduce this.

ii) Respect for rules of justice - the evolution of mechanisms of social exchange meant that "cheater-detection" and "fairness" became important qualities. These developed into systems of justice.

iii) Respect for authority - Krebs (1998) sees this as an extension of the dominance hierarchy found in primate groups. Thus tendencies to conform and respect authority have benefits in maintaining cohesiveness and social stability within the small groups of early humans. So these characteristics have evolutionary benefits.

INGROUP COHESION AND OUTGROUP HOSTILITY

Co-operation within the group of early humans is seen as crucial for survival. So behaviours will evolve to encourage this, and where co-operation broke down, there would be problems.

Hyland (1993) has argued that certain illnesses (like colds) evolved to force "hostile" members of the group to become dependent on the group for care. What are minor illnesses today, would have been serious in the past and encouraged the need for mutual support to survive. The evidence is that negative behaviour leads to stress, and the immune system is suppressed and thus the individual is prone to physical illness. Speculation again here though.

Favouritism to the own group has evolved to improve survival of individuals within that group, and as a consequence suspicion of outsiders. Within the ingroup, the individual will have developed "trust" (through the ability to keep score in terms of reciprocal altruism), and to predict the behaviour of these group members.

But outsiders, nothing is known about them in these respects. The principles here from "small tribal groups" of early humans have transferred to nationalities and ethnic groups today.

Van der Berghe (1981), for example, sees the feelings of kinship as generalised to ethnic groups in multi-cultural societies. While Goldsmith and Zimmerman (2001) develop these ideas to explain the evolutionary basis to war.

Wetherell (1996) is critical of these ideas applied to social issues. There is a problem that:

a large modern ethnic group, often criss-crossed by internal conflicts, resembles in any sense the small kin groups on which the original theory is based (p187).

Furthermore, these ideas cannot explain the variations in concern about "race" or ethnicity in different societies, and nor how groups divided and formed into new ones.

CULTURE

The debate about the origins of culture and its uniqueness to humans is vast, and too much to include here. It is well developed in Tooby and Cosmides (1992) for early humans, and Whiten et al (1999), and Goodall

and Vinson Lonsdorf (2002) for chimps.

The other question is whether "cultural evolution" has superseded biological evolution for modern humans - for example, through the concept of "memes" (Blackmore 1999) (15) or "new replicators" (Dennett 2002).

Cartwright (2000) summarises the main views (full discussion in Janicki and Krebs 1998):

- i) culture as autonomous from biology;
- ii) culture as a reflection of genotype - different environments have lead to development of different cultures to maximise fitness (eg: Cziko 1995);
- iii) genes and culture in co-evolution (eg Lumsden and Wilson 1981);
- iv) culture as evolution of "memes" (Dawkins 1989).

While Janicki and Krebs (1998) highlight the questions that have to be answered by any model:

- What is the relation between biological and cultural evolution?
- What are the psychological mechanisms and processes that mediate the selection and transmission of culture?
- What is the relation between genetic and cultural influences on human behaviour?

MISCELLANEOUS

Table 11 gives a brief summary of some other behaviours and evolutionary explanations (with references).

BEHAVIOUR	POSSIBLE EVOLUTIONARY EXPLANATION
- self deception in relationships by males	- more convincing to females and thus more successful (Robert Wright "Analysis: Basic Instinct" 1997; BBC Radio 4)
- disgust	- linked to disease and avoidance (Valerie Curtis "Human Instinct: Born to Survive" 2002; BBC TV)
- risk taking	- balance of travelling to get food vs starvation if stationary ("Human Instinct: Born to Survive" 2002; BBC TV)
- disease and immune system	- "Darwinian medicine" (Nesse and Williams 1998; Stearns 1999; 2002)
- preference for landscape painting	- "Savannah hypothesis": preference from past habitat (Orians and Heerwagen 1992)
- gender differences in perceptual abilities	- different abilities needed to hunt by males compared to child-rearing for females (Silverman and Eals 1992)
- language	- links to tool-making (Gibson and Ingold 1992) or art (Davidson and Noble 1989) or form of social grooming (Dunbar 1996)
- applications of EP	- developmental psychology (Surbey 1998); cognitive psychology (Kenrick, Sadalla and Keefe 1998)
- evolution of State	(Hedrick-Wong 1998); evolutionary economics (McCabe and Smith 2002)

Table 11 - Miscellaneous evolutionary explanations.

Evolutionary Explanations of Mental Illness

Stevens and Price (1996) have introduced the idea of evolutionary psychiatry - the application of evolutionary ideas for explaining mental disorders. Certain behaviours that are now classed as mental disorders either had an adaptive value in the past or are a maladapted version of an adaptive behaviour.

Nesse (1999) lists the eight vulnerabilities to disease that come from evolutionary thinking (table 12). There is no one explanation for mental illness with the Darwinian perspective (Nesse 1999).

VULNERABILITY	DESCRIPTION/EXAMPLE
1. Defence	- what is seen as disease or defect is, in fact, adaptive: eg anxiety/depression
2. Conflict between pathogens and their hosts; ie: pathogens evolve faster	
3. Mismatch between bodies and novel aspects of physical environment; eg: eating disorders	
4. "Genetic quirks"	- only harmful in novel environments to some individuals
5. "Design trade-offs"	at level of gene; eg: two copies of gene are adaptive and one copy is maladaptive
6. "Design trade-offs"	at level of trait or behaviour; eg: anxiety vs risk-taking
7. Path dependence	- technology changes faster than evolutionary changes; eg: eating disorders
8. Random factors affecting gene pool	

Table 12 - Eight vulnerabilities to disease.

Stevens and Price (1996) detail some of the possible evolutionary explanations for mental disorders:

i) Normal distribution theory - any behaviour or trait has a normal distribution of its characteristics, and the mean is the adaptive version. Thus there will be a few individuals at the extremes.

For example, take arousal in response to danger and the subsequent adaptive value of escape. Anxiety Disorder could be one extreme, where arousal occurs without the presence of danger, and Anti-Social Personality Disorder involves little arousal even in extreme danger. Both these extremes are maladaptive versions of the adaptive behaviour of arousal.

Nesse and Williams (1994) talk of anxiety under the "smoke-detector principle". The extremes are where the "smoke-detector" does not work properly - either too sensitive or not at all.

ii) Genotype-environment interaction theory - different behaviours evolved in different environments, and it may be that the behaviour is maladaptive to the current human environment.

For example, extraversion as a behaviour is adaptive in crowded habitats, but is maladaptive in solitary situations. While introversion will be the opposite.

iii) Activation and inhibition of psychological mechanisms - old evolved behaviours may not have been replaced by the newly evolved ones. Thus "both primitive and modern processes" operate in parallel.

For example, the fear of leaving the house (agoraphobia) is caused by the old evolved strategy that kept early humans away from open spaces (and danger).

iv) Social homeostasis theory - behaviours have evolved to maintain stability (homeostasis) in the social hierarchy. This is used to explain depression (see later).

vi) Inclusive fitness theory - individuals assess themselves against their peers, and if they are "weaker" in evolutionary terms, this may cause depression. The depression makes them refrain from competition for mates, and withdraw socially (including suicide). Thus leaving more resources for their kin.

vi) Ontogenetic theory - this is another way of saying that childhood experiences influence adult development.

Stevens and Price (1996) go through all the main mental disorders and give the evolutionary explanations. I will concentrate on three main categories as examples: anxiety and phobias, schizophrenia, and depression.

ANXIETY/PHOBIAS

Phobias are an excessive or maladaptive expression of an evolutionary beneficial fear response. Obvious fears, like snakes or heights, have evolutionary advantages. Thus there is a "preparedness" to become afraid of certain things without learning (Seligman 1971).

Nesse and Williams (1996) showed how monkeys raised in captivity, who have never seen a snake before, react with fear immediately at the appropriate alarm call when

a snake appears.

Bennett-Levy and Marteau (1984) has shown how the "preparedness" to fear certain animals by humans is linked to how different they are to the human form. Thus an evolutionary advantage in fearing what is clearly different to humans.

Brewer (2001) lists the weaknesses with this explanation in accounting for individual phobias:

i) it cannot account for phobias not related to survival; eg: phobia of loss buttons, or social phobias about eating in public;

ii) it cannot explain why some individual's response is excessive and others not;

iii) in some societies in South America, for example, large spiders are kept as pets, and there is little fear of them.

SCHIZOPHRENIA

Stevens and Price (1996) propose the group-splitting hypothesis to account for the evolution of the characteristics that are now called "schizophrenia" ⁽¹⁶⁾. As early humans formed groups, there would come an optimum size. Beyond that, the costs outweigh the benefits of group living.

As the optimum size is reached, there is a need for a subgroup to split off. The individual with the characteristics of schizophrenia could be the leader for the split - their "visions" and unusual speech could attract followers. Put another way the charismatic leader or shaman are similar in their behaviour to some of the characteristics of schizophrenia:

a leader needs the sort of charisma traditionally granted by divine will and maintained through direct communion with the gods. It is when called upon to fulfil this exalted role that the schizoid genotype comes into its own (p143).

This is very much speculation.

On the other hand, Crow (2000) sees schizophrenia as a by-product of the evolution of language. A mutation on the Y chromosome led to the development of language, but also the risk of schizophrenia in some cases (with its "strange" linguistic behaviours). This argument fits the

case of sickle cell anaemia - both copies of the gene give a defence against malaria (heterozygous), and one copy only leads to sickle cell anaemia (homozygous) (Daly and Wilson 1983).

DEPRESSION

Nesse and Williams (1996) see the evolution of depression as a means to stop early humans from doing certain behaviours, and thereby increase their survival:

a) Low mood during bad weather discourages going out. The "if there is little chance of a payoff, it is best to sit tight rather than waste energy" strategy.

This is similar to the argument for the evolution of sleep as a means of keeping safe during the darkness hours (Meddis 1975) or conserving energy (Webb 1982).

b) Depression at loss encourages the subordinate in a fight to withdraw without any further damage - a form of "damage limitation". Stevens and Price calls this the "rank theory of depression".

Challenges to Evolutionary Psychology

ALTRUISM

The donation of blood is a prime example of a behaviour that challenges the application of evolutionary principles to all human behaviour. Donating to genetic kin makes evolutionary sense, or donating on a reciprocal basis to another individual can be explained by EP and sociobiology. But donating to genetic strangers or to an organisation without knowledge of who receives the blood appears as "pure altruism".

Singer (1981) is definite: "...people who give blood do so to help others, not for a disguised benefit to themselves". In such situations, EP relies on two answers - to speculate about the evolutionary benefits of the behaviour, or to suggest that certain behaviours are maladaptive or not adaptive.

Alcock (1993) reflects on the latter:

..it would not be surprising if human behaviour with its vast cultural diversity was filled with oddities and artefacts that violated expectations derived from evolutionary theory, especially since so many human actions...are very recent cultural phenomena (p542).

Concerning the speculation of the evolutionary benefits of such behaviour as blood donation, Alexander (1987) argues that a donor shows to others that they are a "good person" - a desirable person to include in the group, or even a sign of a potentially "good mate". In other words, "if I am willing to give blood to strangers, then I will be helpful in the upbringing of our offspring".

This argument can be applied for many "culturally-approved" behaviours. It should hold strongest for men in terms of sexual selection.

It should be expected that donors would want to publicise their charity with a badge, for example. This still leaves anonymous and secretive donations to be explained.

EP also counters with the idea of reciprocal altruism, and its role in the evolution of the brain (Crook 1980). The need to keep detailed mental records of who we owe and who owes us. Trivers (1985) sees the evolution of emotions, like gratitude, sympathy, guilt, and shame as linked to "cheater-detection".

Reeve (1998) explores the different explanations for

altruism proposed by EP: from kin selection to by-product mutualism, and reciprocity, and social contract models.

POLITICS AND CRITICISMS

EP produces concern because of the implications of the ideas, and the history of the use of evolutionary thinking (eg: eugenics movement). It also has to deal with accusations of sexism and racism (discussed in Cartwright 2000). While Ruse (1989) addresses the feminist critiques of sexism.

Behaviours that EP finds it difficult to explain includes homosexuality. LeVay (1993) speculates that the "gay gene" might make a contribution to genetic perpetuation by being good at helping heterosexual relatives in child-rearing. While Toates (1996) suggests that it may confer an evolutionary advantage (eg: creativity) in heterosexual matings by gay individuals.

Another explanation is called the dominance failure theory. Subordinate males unable to mate with females, and who experience rejection, give up their losing struggle and turn to homosexuality (Stevens and Price 1996). The authors, however, do admit that they cannot be sure of the explanation.

Other challenges to EP include grief (discussed in Archer 1999), self-sacrifice in war, chastity, suicide, and "death-bed confessions".

Smith and Stevens (2002) summarise the two main criticisms made of EP:

i) The deterministic nature of evolutionary explanations. The degree of determinism involved is open to debate.

Cartwright (2000) notes four positions on a spectrum for explaining all behaviour (including non-human animals): unlearned patterns of behaviour invariant with respect to the environment; unlearned but modified by learning; selectively learnt or selectively expressed; and learnt behaviour.

ii) The use of early humans as the model for explanations of modern behaviour, when the modern world is so different, and a limited amount is known about early human behaviours.

Hayes (1986) is specifically critical of sociobiology as "fundamentally magical and unscientific", but the criticisms are equally applicable to EP. She is particularly unhappy about the use of formulae, like kin

selection, which are applied in retrospect, as well as difficulty in disproving the ideas.

There are concerns about the political ramifications of EP; ie: it fits with the individualism of modern capitalism ("Man, Beast and Politics" 2001; BBC Radio 4). Segal (2001) takes issue with "Neo-Darwinians" who apply EP to social policy decisions.

END NOTE

An evolutionary explanation for why men get hairier as they get older. The male evolved athletic ability to chase and hunt woolly mammoths. But this ability wanes with age, and older males must use another strategy.

A liberal covering of hair acted as rudimentary camouflage, allowing them to get close to their prey without arousing the suspicion of the short-sighted mammoths, who saw them as kin. The fact that men's ears and noses also continue to grow into old age adds weight to the theory (Feedback, New Scientist 30/11/2002 p80).

This explanation is meant to be tongue-in-cheek, but it looks remarkably similar to the serious explanations proposed by EP. I say no more.

Footnotes

1. This is a key point emphasised throughout EP because evolutionary psychologists are acutely aware of the social concerns and implications of evolutionary ideas. For example, arguing that male dominance and promiscuity are adaptive will offend many people.

My problem, briefly, is that if a behaviour is adaptive, what are the incentives to stop it or for society to control it? Thus implicitly evolutionary ideas are a form of moral code ("ought to") whether EP like it or not.

Many of those supporting EP talk of the "naturalistic fallacy"; ie: Nature cannot tell us how to live. Whereas others, argue that "happiness involves following Nature". Kingsley Brown, for example, proposes an evolutionary explanation of the "glass ceiling" at work, which limits how far women can be promoted ("Analysis: Basic Instinct 1997; BBC Radio 4).

2. Sometimes called EMBAS ("evolution-minded adaptationist behavioural science") (Brown 1999).

3. "Environment of evolutionary adaptation" is not an easy concept to define: at one level, it is the hunter-gatherer lifestyle and environment of early humans, but, at another, it is "an abstract concept that attempts to put together the range of selective pressures that have given rise to human characteristics" (Foley 2002 p307).

4. Homo sapiens are said to have appeared around 200 000 YA.

5. Tinbergen (1963) four questions about any animal behaviour:

1. What are mechanisms that cause behaviour? (causal question)
2. How does behaviour come to develop in individual? (ontogeny question)
3. How has behaviour evolved? (evolution question)
4. What is survival value of behaviour? (functional question).

Example of four questions applied to maternal care (Laland and Brown 2002);

Question 1 - what are hormonal mechanisms that elicit care?

Question 2 - How does care change in mother as more experienced?

Question 3 - Why in humans did maternal care evolve?

Question 4 - What led to maternal care to be favoured by natural selection?

6. Only 14 of 2769 marriages in 211 kibbutzim were members of the same peer group (quoted in Boyd and Silk 2000).

7. Feminist is used in the wider sense of "those who see women as exploited, devalued and oppressed, who are committed to changing this, and who consequently adopt a critical perspective towards dominant intellectual traditions that have ignored or justified women's oppression" (Acker et al 1991 pp150-1).

8. Brewer (2002) explores the arguments around the "male biological sex drive" discourse and how Thornhill's work, among others, justifies it.

9. It does not take account of "gang rape" (Hollway et al 2002).

10. Brewer (2000) quotes research with male undergraduates in USA which shows the "acceptability" of "date rape" in certain circumstances: where there is a history of sexual intercourse between the couple; the man

paid for an expensive outing; the woman agreed to go to man's house after the date; the woman asked the man out; and the woman waited until late in the sexual encounter to protest.

11. This whole issue of "Behaviour and Brain Sciences" (no.15 1992) is devoted to articles discussing the evidence for EP and male mate choice.

12. It is unclear how the process of "choosing" the sex of the offspring works. For example, the hormones from the mother could influence the production of girls, and testosterone from fathers for boys. High social ranking males could have more testosterone and thus "determine" the sex of their offspring as male (Cartwright 2000).

13. The sex ratio is discussed generally under:

a) the Fisher hypothesis (Fisher 1930) - the production of male or female offspring favours the "cheaper" sex;

b) the Trivers-Willard hypothesis (Trivers and Willard 1973) - females in good environmental conditions favour the production of sons, while those in poor conditions favour daughters (Cartwright 2000).

These ideas explored further in Sieff (1990).

14. Hunter-gatherers today are believed to live as our ancestors did, and so there is a lot of interest in their study. However, there are few large groups left. The table below lists the number of the main groups that still exist by continent.

CONTINENT	NUMBER	EXAMPLE
Africa	4	!Kung (San) - southern Africa
Asia	6	Ainu - Japan
Australasia	4	Walbiri - Central Australia
North America	9	Algonkia - Canada
South America	7	Yaghan - southern point of continent
Europe	0	

(After Cavalli-Sforrs and Cavalli-Sforza 1995)

Table showing number of main groups of hunter-gatherers today by continent.

15. "Memes" are discussed in a series of articles in the "Scientific American" October 2000: Blackmore vs Boyd and Richerson, and Plotkin.

16. Technically, Stevens and Price (1996) are attempting to explain "schizoid characteristics" as found in the categories of schizoid, schizotypal, and paranoid personality disorders, and schizophrenia.

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